Specialty area: Myocardial function: Beyond systolic dysfunction

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Highlights: Global systolic function is a suboptimal measure of myocardial performance.
Analysis of regional or diastolic function is more sensitive for myocardial dysfunction.
Myocardial synchrony is an important parameter in heart failure and is based on highly-resolved regional function analysis.

MYOKARDIAL FUNCTION: BEYOND SYSTOLIC DYSFUNCTION

Target audience: Clinicians (radiologists and cardiologists) and physicists engaged in cardiac MRI

Outcome/objectives:

The audience will get aware that myocardial dysfunction and heart failure is not equal to reduced systolic left ventricular ejection fraction. Different function parameters and MRI methods of regional myocardial function analysis will be presented and the value of these MRI methods versus echocardiography will be discussed.

Purpose:

About 50% of patients with heart failure have a preserved global systolic function. Global systolic function parameters are not sensitive for myocardial dysfunction as they are dependent on anatomy and loading conditions. They do not reflect diastolic, regional function or rotation. Echocardiography has demonstrated the value of these function parameters but suffers from high dependency on the experience of the examiner and the image quality leading to low reproducibility in clinical studies.

Methods:

A variety of MRI methods as Phase Contrast imaging[1] or Myocardial Tagging[2] might overcome these problems. Myocardial velocities, as well as deformation parameters as strain or strain-rate may be analyzed by MRI with high temporal and spatial resolution within the complete left and right ventricle.

Results and Discussion:

Velocity and deformation parameters of myocardial performance, mainly based on echocardiography, correlate with invasive measures of cardiac performance. However, in contrast to echocardiography MRI-derived parameters of regional myocardial motion are more robust and reproducible. Using MRI a regional inhomogeneity [3,4] of myocardial performance within the healthy ventricle has been demonstrated as well as a dependency on age and gender[4]. The value of regional function parameters and rotation based on MRI has been examined in cardiac diseases characterized by diastolic dysfunction as hypertrophic cardiomyopathy [5] and hypertension [6]. Furthermore, MRI- based dyssynchrony analysis might improve the management of patients with heart failure enabling an optimization of the lead position and the selection criteria for cardiac resynchronization therapy [7]. In valvular heart disease myocardial performance may be overestimated by simple systolic function parameters due to increased ventricular loading.

In patients with coronary artery disease and after heart transplantation regional function parameters may help to diagnose viable or ischemic myocardium resp. early stages of transplant rejection before global systolic function is depressed.

Conclusion:

MRI offers a variety of new modalities for clinical studies of myocardial performance beyond global systolic function analysis. Such studies are needed to improve the non-invasive diagnostic accuracy in heart diseases and the therapy of patients with systolic and diastolic heart failure, ischemic and valvular heart disease.

References:

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